

Operations for Fractured  
Femur: Eleven Suc-  
cessful Cases.

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NEW YORK



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## OPERATIONS FOR FRACTURED FEMUR: ELEVEN SUCCESSFUL CASES.\*

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Mr. Dent, who for many years observed and followed the fractures occurring among the Metropolitan Police in London, concluded that fractures of the femur uniformly lead to permanent unfitness for the work that developed on those men. Ericksen wrote that fractures of the upper third of the bone were invariably unsatisfactory in results. These cases are especially difficult to treat, as it is almost impossible to preserve their alignment. The lower end of the upper fragment is drawn upward and rotated outward, while the upper end of the lower fragment is drawn upward and inward. It is interesting here to recall also the conclusions of Allis in 1890 that the conversion of a simple fracture into a compound fracture affords the only means of accurate diagnosis and the only method of rational treatment of fractures at the upper third of the femur, and that patients and surgeons who stop short of this must compromise with the best results. These and numerous other records indicate that the results of conservative treatment in thigh fractures have not as a rule

\*Read before the Greater New York Medical Association, November 1910.

conformed to the high ideals which govern every modern surgical undertaking.

During the past two decades almost the whole body of modern surgeons has appeared to be concentrating its attention upon abdominal lesions, so that the treatment of fractures, which are of most frequent occurrence, has been somewhat neglected. The old method of treatment by splints has not



Fig. 1.

progressed to anything like the extent which other and more recent branches of surgery have—such, for instance, as the surgical treatment of abdominal lesions. Since the *x*-rays have enabled one to see and photograph the broken bones, the public have taken an increased interest in fractures and are demanding greater skill in their treatment. Many eminent surgeons of acknowledged skill and broad

experience approach ordinary thigh fractures with guarded prognosis. In the past they accepted results as satisfactory which are now considered most unsatisfactory. In 1891, Stephen Smith, as chairman of the fracture committee of the American Surgical Association, asserted a "satisfactory result to be present when shortening did not exceed one-half to one inch."

A *satisfactory* result is often too elastic a term. Shortening sufficient to entail permanent limping, angularity, and rotation are not rarities in surgical



Fig. 2.

experience. Lanninger states that the degree of diminution in the earning capacity of a laborer is dependent upon the amount of shortening.

The renewed prominence given of late to this most interesting and important branch of surgery warrants an extended examination of the situation from all points of view in consideration of the widely divergent opinions held by many of our most eminent surgeons.

I desire to present the following histories, hop-

ing to increase the interest of the profession in developing the operative treatment for selected cases of fractures.

CASE I.—Femur, fracture of neck; female, aged 26; slipped and fell. On the following day a long side splint was applied without extension. With this she was confined in bed for twelve weeks. She left the hospital on crutches and was obliged to continue their use during the following eighteen months, for no union was present. Two years after the original accident she entered Bellevue Hospital. When standing with the aid of crutches the left lower extremity hung apparently helpless; the glutei and other muscles of this thigh were moderately atrophied. Measurements showed 6 cm. shortening, confirmed by a radiograph which showed the great trochanter to be displaced far upward.

Treatment was at once begun by applying a Buck's extension with 15 pounds weight in order to reduce the shortening if possible. The weights were very gradually increased up to 45 pounds. At the end of six weeks the continuous traction had diminished the shortening to 3 cm.

An operation was now performed to bring the separated fragments together and secure them in apposition.

An incision beginning 2 cm. below the left anterior superior spine was extended downward and backward to the posterior margin of the trochanter and then vertically down the thigh, the soft tissues were divided, the capsule exposed and divided, exposing the fracture which had occurred, roughly, transversely through the femoral neck, the proximal fragment consisting of the upper third of the femoral head. Considerable callus was removed, and the fractured surfaces were freshened by the rongeur. By traction and abduction the freshened fragments were brought together with great difficulty.

A steel drill was passed through the great trochanter, the neck, the head and into the wall of the acetabulum, thus spiking the fragments firmly together. The wound was closed with a small rubber tissue drain. A plaster spica was applied from the lower border of the ribs to the toes.

The wound healed uneventfully; the patient was confined to bed for eight weeks. Four weeks later a Thomas hip splint was applied and she went about on crutches, discontinuing the splint at the end of one year. Five months after the operation, the drill, which was loose, was easily removed by small forceps.

Two years after the operation there is some motion at the hip. Less than 2 cm. of shortening exists. She walks without a cane, is free from pain, and is supporting herself by doing regular work.

CASE II.—Fracture of upper third of femur; male, aged 36 years. Fell from roof, striking upon right hip, pro-

ducing a fracture at the upper third of right femur. Measurements showed 3 cm. shortening and angular deformity. A Hamilton side splint was applied. Two days later a plaster of Paris spica was applied. A radiograph (Fig. 1) was taken which showed an oblique fracture just below the great trochanter, the fracture running from without downward and inward; the lower fragment was displaced about 6 cm. The upper fragment was markedly abducted.

One month after the injury the patient came under my care for operation. An eight inch incision was made on the outer aspect of the thigh and carried down to the fracture. The irregular bony ends had lacerated seriously the adjacent tissues and there was present much unabsorbed blood. The lower fragment was internal and posterior to and overridden by the upper fragment to the extent of about 5 cm. No callus was present about the lower fragment, but some had formed about the upper fragment. Considerable difficulty was experienced in reducing the fracture and bringing the fragments into alignment. Holes were drilled through both fragments, through which silver wire was passed. This maintained the fragments in apposition. The soft parts were united by fine catgut, a rubber tissue drain was inserted and a plaster of Paris spica applied from the pelvis to the toes. Uneventful recovery ensued.



Fig. 3.

The patient was confined to bed for six weeks, and then allowed up on crutches. At the end of ten weeks the spica was removed and a lighter, shorter one applied. At the end of twelve weeks union was present with less than 2 cm. shortening (Fig. 2).

In this case the use of Lane's plates would have made the operation simpler, shorter, and more efficient. I did not have them present. I feel this is true of other operators and would suggest that a set be added to each armamentarium and taken to all cases of fracture operation. It would have



been difficult to have attempted to use any form of intermedullary splint.

CASE III.—Fracture of upper third of femur; male, aged 40 years; while unloading a ship fell into the hold, fracturing his left femur just below the upper third. He was taken at once by ambulance to one of the neighboring hospitals, where a long, side splint was applied. No extension was applied. After remaining at the hospital for seventy-two hours, he was transferred to Bellevue Hospital. Another side splint was applied, together with a Buck's extension, with a weight of 10 pounds. At the end of fifteen days a plaster spica from the pelvis to just below the knee was applied, and he was transferred to the City Hospital on Blackwell's Island. At the end of ten weeks the plaster spica was removed, and it was found that an angular deformity existed with shortening of about 6 cm. He was urged to permit an operation in the hopes of relieving his condition, but would not consent until he found,

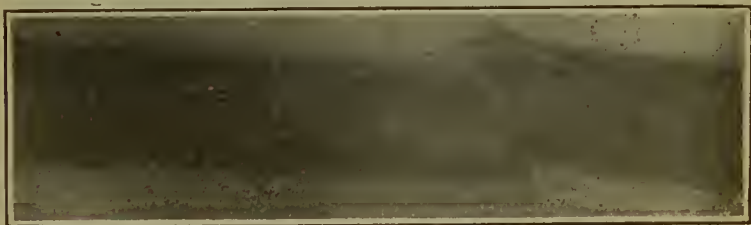


Fig. 4.

on account of his crippled condition that he could not secure any position to support himself and family.

At the end of fourteen months after the fracture occurred I undertook the operation. A six inch lateral incision was made on the outer edge of the thigh. After incising the skin and muscles one came down to a large mass of callus enveloping the overriding fragments. The callus was removed and the overlapping ends were finally separated with great difficulty, accompanied with considerable oozing. After the ends were freed it was easily seen that they could not be approximated end to end on account of the retraction of the adjacent structures, unless the ends were shortened by resection or some other method employed. The incision was lengthened to ten inches, the muscles were further separated from the shaft until the ends of the bones could be easily brought out of the wound. The upper end of the lower portion of the shaft was freshened by sawing so that it became conical. The lower end of the upper portion of the shaft was freshened by sawing it so as to receive the conical end of the lower shaft. At first attempt the bones could not be brought together, except at an oblique angle. However, after thirty minutes' manipulation, the soft structures were gradually

stretched so that the bones were brought into alignment. One strand of silver wire was passed through the ends, and the muscles and fascia were tense and firm enough to keep the ends approximated. The wound was closed with the exception of a small rubber tissue drain. A plaster spica was carefully applied from the pelvis to the toes. Un-



Fig. 5.

eventful recovery followed. There is 2.5 cm. of shortening, and some stiffness in his knee, due to the fourteen months' retention before he submitted to the operation. He has resumed his wage earning work and is much more than satisfied. Unusual difficulties were encountered at this



Fig. 6.

late date which could easily have been avoided had the operation been performed earlier.

CASE IV.—Femur, fracture at middle third; male, aged 12 years. On admission to the hospital the usual long splint was applied. A radiograph taken seventy-two hours after the accident showed a shortening of 2.5 cm. On the



following day under an anesthetic the deformity was apparently reduced and a plaster spica applied. Ten days later a second radiograph was taken which showed 5 cm. shortening. The spica was removed and a Buck's extension applied; two weeks later very little improvement had occurred and operation was advised.

The patient came under my care for operation six weeks after the fracture occurred. An antero-external longitudinal incision was made immediately over the fracture. There was considerable callus among the tissues, which were very vascular. The ends of the fragments were freshened. Two strands of chromic gut No. 3 were passed through holes piercing the bones about half an inch from their ends. The wound was closed in layers, leaving a rubber tissue drain. A plaster spica was applied from the pelvis to the toes. Ten days later the plaster spica was removed and the rubber tissue drain withdrawn; the wound healed primarily. The leg was apparently carefully held while a plaster spica was applied. Four weeks later this spica was removed and I was surprised and embarrassed to again find 4 cm. of shortening. It became painfully evident that when the first spica had been removed the leg had not been held firmly, and that the fragments had again slipped. Undoubtedly this was somewhat due to the use of *chromic* gut instead of wire. I found upon talking with my colleague, the late Dr. Carlton Flint, that he had had a similar case in his own practice, and had also the histories of two additional cases in the practice of others. I explained the unfortunate situation to the family of the patient and requested a second operation, which was granted.

August 13, 1907, eleven weeks after the first operation and eighteen weeks after the accident, the second operation was performed. A six inch incision was made down to the seat of fracture. The soft tissues were infiltrated and greatly matted together. Some callus was found at the *ends* of the bones but not at the sides. After freeing the ends of the fragments four holes were bored through each fragment. The aluminum splints, three-eighths inch in width, one-eighth inch thick and four inches in length, were applied, one to the inner aspect of the fragments and the other to the outer aspect. The fragments were placed in apposition and alignment and fixed firmly by the above splints, which were held securely by aluminum bronze wire.\* The wound was closed with fine catgut, a small rubber tissue drain was inserted, and a plaster spica was applied from the pelvis to the toes.

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\* I have found the aluminum bronze wire excellent in bone work. It is strong, pliable, and can be threaded as easily as silk; it can be knotted with a simple surgical knot and need not be twisted; furthermore, it can be safely sterilized. I used size No. 2, securing it from the Kny Scheerer Company, New York, who are the American manufacturers. It is described in the *Centralblatt für Chirurgie*, No. 35, 1908.

Uneventful recovery followed. Ten weeks later the splint was removed and the patient began to walk on crutches. End result less than 1.5 cm. shortening. Three years have passed since the operation; the plates have caused no trouble. The patient has perfect function.

CASE V.—Femur, fracture of middle third; male, aged 40 years. On admission to a hospital examination showed a transverse fracture; a long side splint was applied. Two days later measurement showed 2 cm. shortening. Under ether anesthesia the fracture was reduced and a plaster spica applied; four weeks later the spica was removed. There was shortening of 4.5 cm. (Fig. 3) and only fibrous union. Two weeks later he came under my care for operation. Considerable callus was present at the ends of the bones. The ends were freshened, and a one-quarter inch intermedullary splint of aluminum was inserted into the lower fragment; the upper fragment was brought into alignment and the splint pushed upward until one and a half inches lay within each fragment. (Fig. 4).

The spica was removed fifteen weeks after the operation; the patient walks easily, without limping, and has no pain.



Fig. 7.

CASE VI.—Femur, fracture at lower third; male, aged 52 years. He was caught between an automobile and an iron fence, jamming his right leg just above the knee. A radiograph showed an oblique fracture just above the condyles and 2 cm. shortening (Fig. 5). Two days later a plaster cast was applied. Six weeks later the cast was removed. Very little union was present. Massage treatment was instituted and the leg placed in a Volkman splint. Eight weeks later only fibrous union was present and shortening had increased to 3.5 cm.

Fourteen weeks after the injury he came under my care for operation. A six inch incision was made on the outer aspect, beginning at about the centre of the external condyle and extending upward parallel to the long axis of the femur. The fragments were exposed. A flap of periosteum folded over the lower end of the upper fragment had become interposed between it and the lower fragment. The lower fragment had become tilted downward and backward by the prolonged traction of the muscles. For this reason it was impossible to restore perfectly the natural align-

ment. After freshening the surfaces of the fragments they were placed in apposition and secured by silver wire.

The wound was closed with fine catgut and a rubber tissue drain inserted. A plaster spica was applied from the pelvis to the toes. Uneventful recovery. At the end of eight weeks the cast was removed. At the end of ten weeks passive motion began. At the end of twelve weeks union was present. The end result was a 2 cm. shortening. One year after the operation there has been no trouble (Fig. 6) due to the silver wire and the patient walks without discomfort.

CASE VII.—Femur, fracture at middle upper third; male, aged eleven years. On admission to the hospital, examination showed an oblique fracture with 3 cm. shortening; a long side splint and Buck's extension were at once applied. Ten days later the shortening still persisted and the fragments could not be brought into alignment. Two radiographs were made, and while one showed the fragments (Fig. 7) in alignment, the other, taken at right angles to the first one, showed the overriding. Operation was advised, and performed fourteen days after the accident. Upon exposing the seat of fracture the ends were found to be separated by a firm flap of periosteum, and they could be brought into correct apposition only after

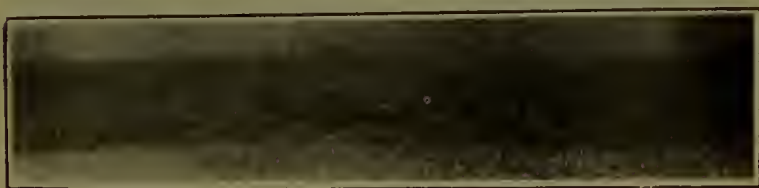


Fig. 8.

this flap had been excised. A steel plate was applied and (Fig. 8) secured by two screws in the lower fragment and two screws in the upper fragment. The wound was closed with No. 1 catgut. The shortening was overcome when the fracture was reduced.

A plaster spica was applied. He remained in bed for six weeks. Three months after the operation he walked without limping or discomfort. Fourteen months have passed without any trouble on account of the plates.

CASE VIII.—Femur, fracture at middle third; male, aged 10 years. On admission to hospital, examination showed an oblique spiral fracture (Fig. 9) with 2.0 cm. shortening; a side splint was applied. On the seventh day a plaster spica was applied from the toes to the pelvis. On the fourteenth day a radiograph showed overriding of 3 cm.; the spica was removed and an extension apparatus applied, but the deformity still presented. Under anesthesia efforts were made to correct the deformity, but proved unsatisfactory. Five weeks after the accident an operation was per-

formed. When the seat of fracture was exposed a flap of periosteum and muscle was found between the fragments. After this was removed, the separated ends were placed in alignment and the shortening was eliminated. A steel plate was applied and secured by two screws in the upper and also by two in the (Fig. 10) lower fragment. The wound was closed completely without any rubber tissue drain. A plaster spica was applied from the pelvis to the toes. He remained in bed for five weeks, and then went about on crutches; the spica was removed, and at the end of six weeks the patient walks without limping and has regained full function of the leg.

CASE IX.—Femur, fracture at upper third; male, aged 60 years. Upon admission to hospital, forty-eight hours after the occurrence of fracture, a long side splint was applied: the following day examination showed a shortening of 4 cm., and Buck's extension was applied, at first with



Fig. 9.

a weight of 20 pounds, which was gradually increased to 40 pounds. At the end of fourteen days there still existed a shortening of 2.5 cm. The radiograph showed the fracture to be an oblique spiral one, and the fragments not in alignment. Mr. Lane, of London, saw the patient, and advised operation. A ten inch incision was made over the outer aspect of the thigh, exposing the fracture. No appreciable callus existed. The fragments overlapped, the lower end of the upper fragment was drawn upward and rotated outward, while the upper end of the lower fragment was drawn upward and inward. Strong traction was applied by two surgeons pulling on the lower leg while a third assistant exerted counter-traction by holding the patient at the shoulders. Two long twelve inch Lane bone forceps were applied, one to the upper fragment, the other to the lower fragment. These were used to manipulate the fragments and to bring them into alignment. The operation was extremely difficult, and while approximating the fragments a large fragment was broken from the upper end of the lower fragment—this was due to the brittle condition of the bone which so frequently exists in old alcoholic patients. The long powerful forceps were not re-



moved, but acted as immobilizers until the Lane plates were employed. Two large plates and one small plate were employed. The skin was closed by a continuous suture of fine black silk. No drain was inserted; a plaster cast was applied from the pelvis to the toes. As the patient had suffered from a fracture at the neck of the same femur



Fig. 10.

twenty years previously, there was but little motion in this hip joint and some adduction was present. The plates were therefore so applied as to increase the amount of abduction. This is seen in the second radiograph, which also presents the appearance of slight non-alignment, but which has really contributed to his favorable result. The wound healed primarily. The cast was removed on the twenty-eighth day; on the forty-second day he was out of bed and using crutches. Six months later there had been no trouble on account of the plates.

CASE X.—Femur, upper third; female, aged 42; stout; Three hours after falling she was brought to a hospital, where a long side splint was applied. Three days later a radiograph was taken (Fig. 11) which showed the usual



Fig. 11.

deformity. Six days after the accident an operation was performed. A six inch incision was made antero-externally; the upper end of the lower fragment was found drawn inward and upward, while the lower end of the upper fragment was drawn upward and outward. There was a shortening of 4 cm. Very strong traction was made

by two surgeons pulling on the leg at the ankle while two other surgeons exerted counter traction by holding the patient at the shoulder. Considerable difficulty was experienced in approximating the fragments. A large sized Lane plate was applied and held in position with six screws; the muscles and fascia were united with fine catgut, the skin with the finest subcuticular catgut suture. No drain was used.

A plaster cast was applied from the pelvis to the toes. Primary union followed. On the forty-second day the cast was removed. On the forty-eighth day the patient was up in a chair and began to use crutches. Union was perfect with less than 1 cm. shortening. A second radiograph was taken (Fig. 12). Thirteen months after the operation the patient walked without limping and there has been no complication from the operation or on account of the plates.

CASE XI.—Femur, upper third; male, aged 16 months. When the infant was delivered by a midwife, the left femur was fractured just below the lesser trochanter. No splint



Fig. 12.

or bandages were applied, therefore the fracture united with considerable angulation. The deformity has increased until now there is about 2.5 cm. shortening.

Operation.—Ether was given, a four inch incision was made antero-externally. The femur was considerably thickened and increased in size, but no callus was present. The femur was sawn through (and a small wedge shaped section removed); this permitted the femur to be straightened and the divided ends to be accurately approximated. A small sized Lane plate was applied and held in position by four screws.

The muscles and fascia were sutured with fine catgut; the skin was united with a subcuticular catgut suture. No drain was used; a plaster cast was applied from the pelvis to the toes. Primary union resulted. Ten days after the operation the plaster cast was removed and a new one



reapplied. Thirty-five days after the operation the cast was removed. Firm union was found to be present. The patient was discharged from the hospital and gradually began to walk, becoming normal within six months. Fourteen months after the operation the child plays about perfectly normal. There has never been the slightest complication in any way.

CASE XII.—Tibia and fibula, fracture of; female, aged 35. Patient slipped and fell, causing a fracture of both tibia and fibula at the lower third. After admission to hospital, side splints were applied. Two days after the accident there was but moderate swelling, and as the position of the fragments seemed good, a plaster cast was applied; thirty days later it was removed. Union did not exist; therefore, a plaster cast was reapplied. Twenty-one days later the cast was removed and there was but very slight union. A radiograph (Fig. 13) was taken. The patient then came under my care for operation. A four inch antero-incision over the tibia exposed the fracture. A flap of periosteum covered the lower end of the upper fragment, separating it almost completely from the lower fragment. There was but little callus present. The ends of the fragments were first curetted; they were then brought into apposition by means of the Lane forceps, when a Lane plate was applied and secured in position by means of four screws. The wound was closed with catgut. No drain was used. A plaster cast was applied. This was removed at the end of twenty-one days. Primary union existed and bony union appeared perfect (Fig. 14). The patient gradually began to walk. Fifteen months after the operation there has been no complication and function is perfect.

CASE XIII.—Elbow, fracture and dislocation of; male, aged 4 years. While playing the patient fell upon left elbow; several hours later he was brought to the hospital.

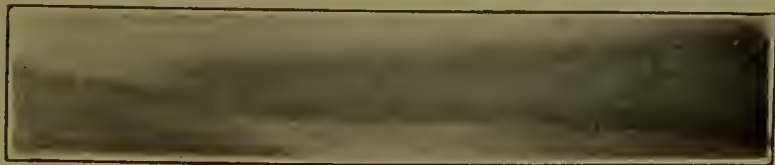


Fig. 13.

The arm was greatly swollen, it was extended and could not be flexed; wet dressings were applied. On the following day a radiograph was taken; it showed the radius and ulna dislocated backward and outward, associated together with a separation of the epiphyses and fracture of the external condyle of the humerus. Ether was given and a reduction and replacement of the fragments was attempted. As it was unsuccessful, an operation was performed. A

four inch median posterior incision was made to expose the fragments. The lower end of the humerus was freed and then drawn backward by a hooked retractor, thus permitting the dislocation to be reduced. The separated epiphyses were replaced and held in position with chromic catgut No. 2. The skin incision was completely closed with fine silk sutures. No drain was used. The arm was flexed at an acute angle; a plaster cast was applied. Primary union followed. On the eighteenth day the cast was removed and gentle passive movements begun. At the end of six months motion was nearly normal. One year after the operation there has been no complication following the operation. Function has been restored.

In fractures the rapidity and completeness of cure are proportional to the accuracy of reduction and the retention of the fragments. When anatomical replacement has been secured, and the fragments are in direct apposition, healing results more quickly and more firmly than where there is overlapping and a corresponding increase in callus formation. Delayed union is largely due to faulty adjustment. It is, therefore, most important that the reduction of the displaced fragments should be made complete and perfect at once. Nailing or suturing the fragments does not increase the nutrition of the parts, but it does bring the fragments into early intimate contact, and when the fractured surfaces are in proper contact primary healing results. The cases which give trouble are those in which there is overlapping and shortening, or when the bones have united at an angle.

"Those whose occupations necessitate much standing and moving about require an especially careful adjustment of fractures of the lower limbs with regard to the distribution of weights, or else their earning capacity will be reduced by the discomfort produced by strains upon muscles and joints—an all too common occurrence. It should never be lost sight of that these unfortunate results can

usually be avoided by a timely and skilful operation."

The surgeon must remember that the result of his treatment, whether operative or not, will probably be submitted to the test of radiography and

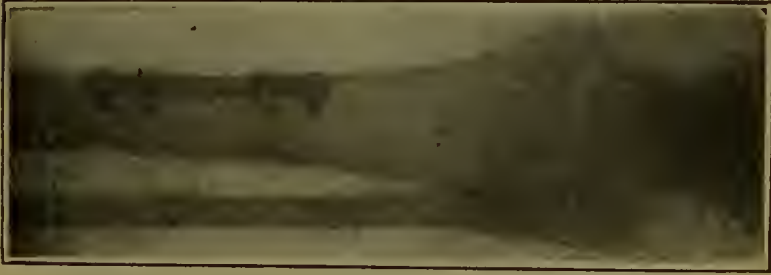


Fig. 14.

that if brought before a jury it will be likely to regard any marked irregularity in the form of the bone as indicating a want of sufficient skill on the part of the surgeon, for the jury will have been instructed by counsel that our own creed teaches that the surgeon who has not placed the fragments in accurate apposition has not performed his work properly.

He must, therefore, be most careful to have fractures carefully x-rayed in planes crossing each other at right angles, so that any displacement may not escape his observation. In any case the surgeon who does not insist on efficient radiograms being taken at the earliest moment in any suspicious case of injury renders himself liable to much criticism and financial loss in the future.

#### CONCLUSIONS.

The operation should be performed as soon after the injury as it has been determined that reposition is possible by no other method. It is better to clear out the clots at once than to wait for ab-

sorption, as it diminishes the chance of sepsis. Traumatic reaction is going on all the time, so long as the bones are out of place, or so long as they are movable. The bone fragments injure the surrounding soft tissues, thus producing exudation and swelling. *The longer the delay the more the tissues contract and the chief difficulty in the reduction of fractures is the shortening of the tissues which so displaces the fragments.*

If a fracture be considered as a wound the sooner and more accurately the wound surfaces are brought together and retained in apposition the less will be the swelling, and the more perfect the healing.

1. The operative method is indicated for the immediate accurate reduction of displaced fragments of long bones whenever it is impossible to correct the deformity without operation.

2. For the removal of soft parts between the fragments, which is the most frequent cause of non-union.

3. When properly performed with suitable instruments it does not cause extensive laceration of tissue nor increase the risk of suppuration. It is absolutely necessary that an asepsis be observed which is far superior to that requisite for other operations because a considerable quantity of metal is left in the wound. As these operations are usually very difficult, it is necessary that the surgeon and his assistants acquire special skill.

4. It diminishes the unfavorable results of conservative treatment; it simplifies the usual treatment, for extension is seldom required, and tight splinting is unnecessary. Physiological rest, so essential to rapid and uneventful healing, is frustrated by circular compression. It permits earlier massage and passive motion, which is of so much

importance in connection with joints in the earlier restoration of function.

5. It is *necessary* in fresh cases in which the fragments are irreducible or cannot be molded into place or cannot be kept in place after a fair trial, or in cases in which there is involvement of the *joints* with loose or unmanageable fragments, in *older* cases of vicious union with malposition of various kinds, which interfere with perfect function.

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